



Greenhouse Gas Inventory 2009



Sustainable Beaverton

Greenhouse Gas Inventory

City Operations

Scopes I, II and III

Beaverton, Oregon



CITY OF BEAVERTON

GREENHOUSE GAS INVENTORY

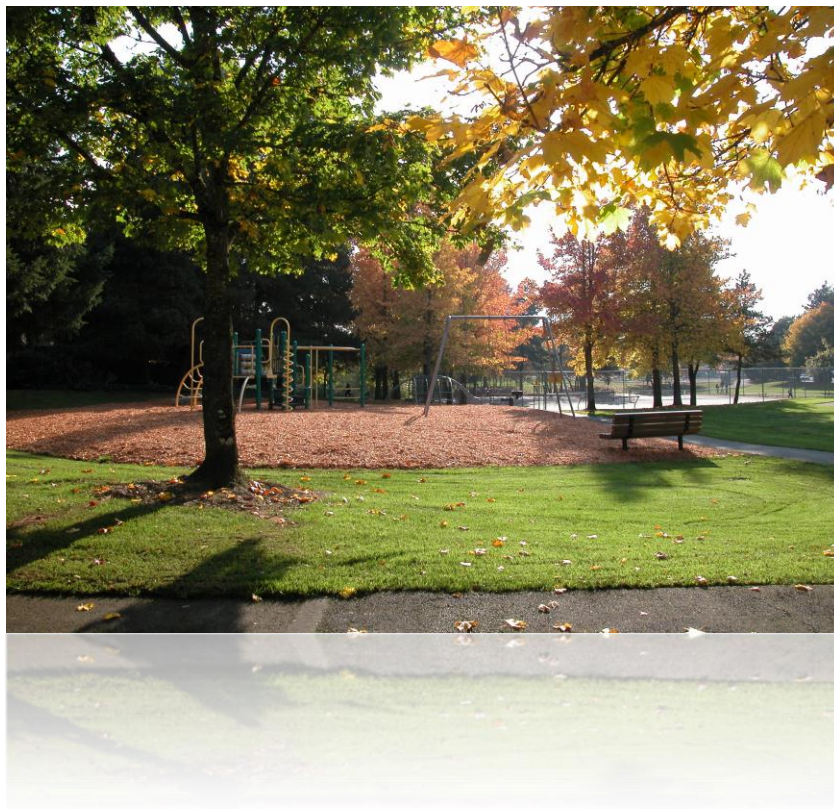
LOCAL GOVERNMENT OPERATIONS FOR 2009

SEPTEMBER 30, 2010

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INTRODUCTION AND POLICY CONTEXT

The Intergovernmental Panel on Climate Change (IPCC), the United Nations body that regularly convenes climate scientists, has identified human activity as the primary cause of the climate change that has occurred over the past few decades and quickened in recent years. Consensus statements from the IPCC suggest that human-caused emissions must be reduced significantly – perhaps by more than 50% globally, and by 80% in wealthier nations that are the largest emitters – by mid-century, in order to avoid the worst potential climate impacts on human economies.

Many corporations, government agencies, universities, non-profits and individuals have proactively sought to take on this challenge. Emissions from city government operations can be significant; accordingly, cities have a direct impact through emissions reductions. Cities also have a role in educating policy makers and citizens.

By measuring emissions from the City of Beaverton's operations, this inventory is a step toward taking action, managing risk and leading the way forward to a more sustainable city.



There has recently been much regulatory action regarding greenhouse gas (GHG) emissions, as well as energy and transportation legislation and climate action policy initiatives. Action is taking place at the international, national, regional, state and local levels as shown in Figure 1 (below).

Figure 1: Overview of Policy Activity Related to Greenhouse Gas Emissions Management

International

The world's leaders met in Copenhagen in December 2009 to negotiate the next international climate agreement to follow the Kyoto Protocol, which is set to expire in 2012. While the Copenhagen Summit did not result in any legally binding emissions reductions targets, the Copenhagen Accord, which was drafted by the United States, China, Brazil, India and South Africa, calls for nations to take actions to keep increases in global temperatures below two degrees Celsius.

Federal

The US Congress is considering sweeping energy and climate legislation. The American Clean Energy & Security Act (ACES) was passed by the U.S. House of Representatives in June 2009. Sen. John Kerry and Sen. Joe Lieberman introduced the "American Power Act" bill draft to the U.S. Senate in May 2010. In parallel, the US EPA has issued mandatory reporting guidelines for large emitters. Other energy and economic stimulus legislation recently passed by the federal government supports renewable energy development and other climate-related initiatives.

Regional

The three regional initiatives – Western Climate Initiative (WCI), Midwest Greenhouse Gas Accord (MGGA), and Regional Greenhouse Gas Initiative (RGGI) – continue to move forward and prepare for implementation (in the event that the federal government does enact climate legislation) or pre-emption (if federal law takes over). RGGI was already underway as of 2008.

State

In Oregon, recent legislation includes climate and energy bills targeting fuels, solar power opportunities, and GHG emissions from land use and transportation. A number of statewide efforts are facilitating the widespread deployment of electric vehicles. Dozens of states are taking these and similar actions.

Local

At the local level, over 1000 cities across the country have signed the US Mayors Climate Protection Agreement (www.usmayors.org/climateprotection/agreement.htm), including 15 in Oregon, and the City of Beaverton (2006). A comprehensive GHG inventory is the first step toward fulfilling a signatory's commitments. We hope this process will serve as a starting point to improve the City's policies and practices that affect the quality of our environment, as well as provide encouragement and momentum to other communities that may still be at early stages.



BOUNDARIES

In GHG inventory protocols, emissions sources and activities are classified as either producing direct or indirect GHG emissions. Direct emissions are those that stem from sources owned or controlled by a particular organization. Indirect emissions occur because of the organization's actions, but the source of emissions is controlled by a separate entity.

To distinguish direct from indirect emissions sources, three “scopes” are defined for traditional GHG accounting and reporting purposes.¹

Scope 1

Direct sources of GHG emissions that originate from equipment and facilities owned or operated by the City of Beaverton.

- *Example: The City burns natural gas at its facilities to generate heat.*

Scope 2

Indirect GHG emissions from purchased electricity.

- *Example: An electric utility burns fossil fuels to generate electricity and then transmits the power to the City.*

Scope 3

All other indirect sources of GHG emissions that may result from the activities of the City of Beaverton but occur from sources owned or controlled by another company or entity.

- *Examples: Business air travel, embodied emissions in material goods purchased by the institution, emissions from landfilled solid waste and the commuting habits of City employees.*

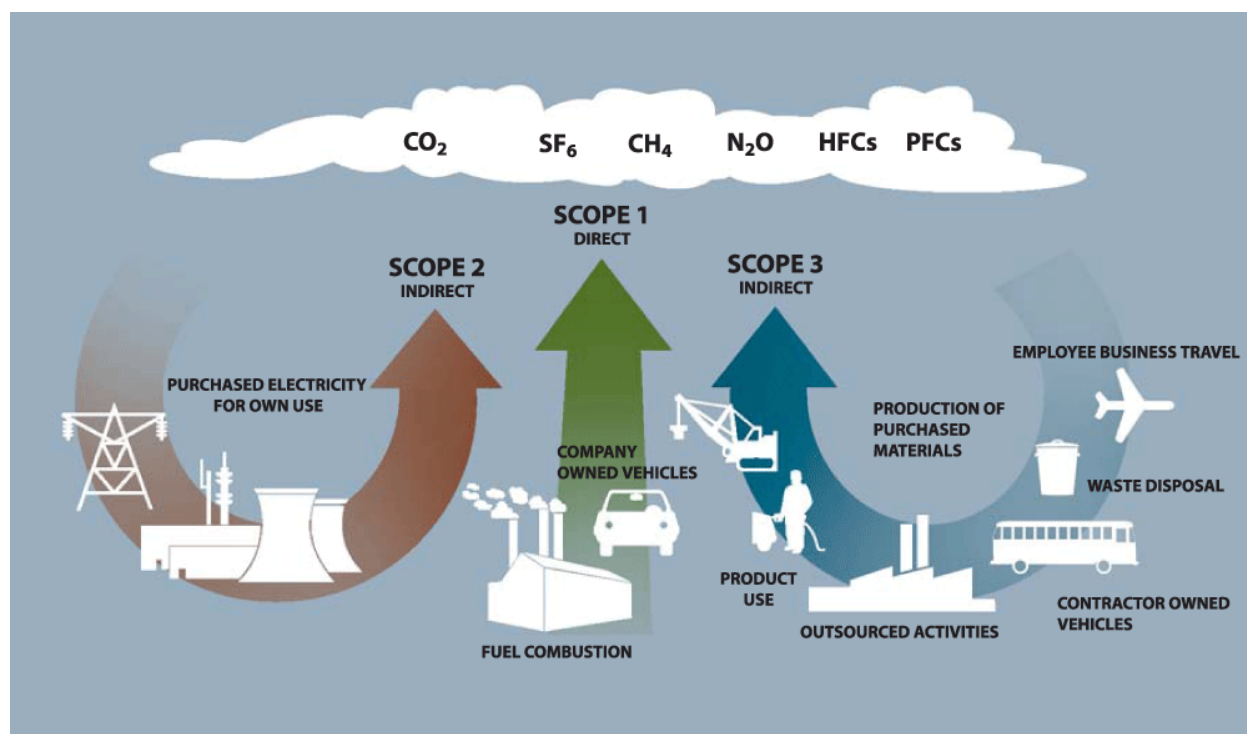
Scope 1 (direct) and **Scope 2** (indirect) emissions must be reported for most protocols and registries. **Scope 3** emissions are indirect and usually considered optional when reporting emissions, but serve to clarify an organization's entire carbon footprint and illuminate the potential regulatory and financial risks an institution may face as a consequence of that footprint.

Figure 2 (on the next page) illustrates the three scopes of emissions.

¹ World Resources Institute, The Greenhouse Gas Protocol, p. 25 <www.ghgprotocol.org/standards/corporate-standard>



Figure 2: Greenhouse Gases and Accounting and Reporting Scopes



Source: WRI/WBCSD Greenhouse Gas Protocol, Corporate Accounting and Reporting Standard (Revised Edition), Chapter 4.

OVERVIEW OF RESULTS

This inventory was carried out using high-consensus protocols and tools, and in accordance with Oregon Department of Environmental Quality guidelines. This inventory attempted to cover all six of the gases targeted for emissions reductions by the Kyoto Protocol, including:

- carbon dioxide (CO₂)
- methane (CH₄)
- nitrous oxide (N₂O)
- sulfur hexafluoride (SF₆)²
- perfluorocarbons (PFCs)²
- hydrofluorocarbons (HFCs)²

All emissions in this inventory are reported in **metric tons of carbon-dioxide equivalent (MT CO₂e)**.

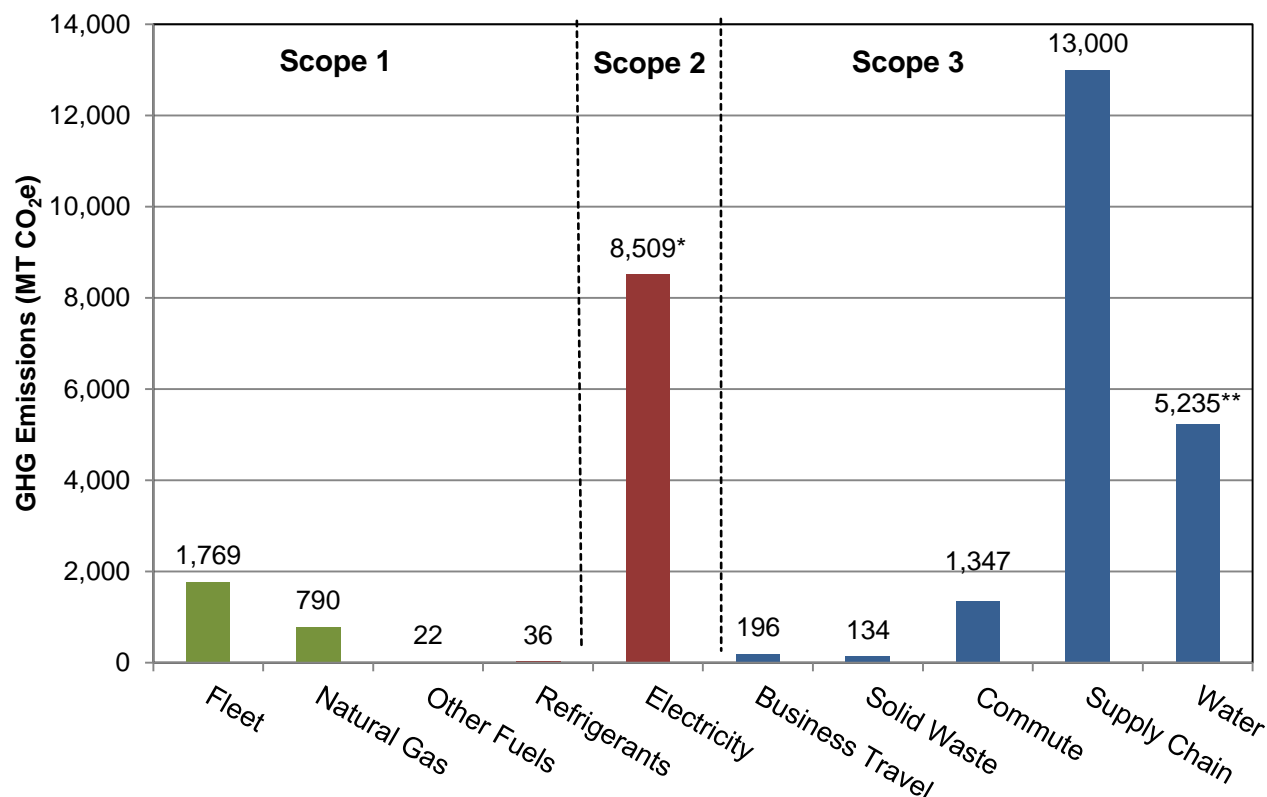
The City of Beaverton's 2009 Scope 1 and Scope 2 emissions from fuel and power use by buildings and vehicles totaled 11,126 MT CO₂e. In addition, this inventory identified an estimated 19,912 MT CO₂e of other emissions from mission-critical activities related to the City's operations but outside of its direct control (Scope 3). Overwhelmingly, the direct and indirect CO₂-equivalent emissions are CO₂ from combustion of fossil fuels.

² SF₆, PFCs and HFCs are considered to be the major groups of gases with high global warming potential (GWP), from 140 to 23,900 times higher than the GWP of CO₂ (www.epa.gov/highgwp).



Figure 3 (below) illustrates the City of Beaverton's total GHG emissions for 2009. More detailed information about the methods used to calculate these emissions, and a sensitivity analysis for each emissions category, can be found in the *Methods* section of this report.

Figure 3: City of Beaverton's GHG Emissions from Local Government Operations (2009)



* GHG emissions for electricity were based on Portland General Electric's utility specific factor, which was 1617.2 lbs CO₂/ MWh as reported to the EPA for 2005 (www.epa.gov/cleanenergy/energy-resources/egrid/index.html). For the sensitivity analysis comparing utility specific, regional and national emissions factors for electricity, please see the *Methods* section.

** This category is based on emissions reported by the Joint Water Commission for treatment and storage of water purchased by the City of Beaverton for distribution. These emissions are not based on fuel used directly by the City of Beaverton for heating, cooling or treating water; hence, the Scope 3 designation.

Greenhouse Gas Equivalencies³

Scopes 1 and 2 emissions yielded 11,126 MT CO₂e. For sense of scale, this is equivalent to:

- Annual emissions from 2,127 passenger vehicles
- Annual emissions from the energy consumed by 947 homes (US average)

Scope 3 emissions yielded 19,912 MT CO₂e. For sense of scale, this is equivalent to:

- Annual emissions from 3,807 passenger vehicles
- Annual emissions from the energy consumed by 1,695 homes (US average)

³ Computed using the EPA Greenhouse Gas Equivalencies Calculator (updated March 2010), available from www.epa.gov/cleanenergy/energy-resources/calculator.html (accessed July 29, 2010)



Figure 4 (below) describes the emissions sources for each category in all three scopes. For perspective, the City of Beaverton employed 488 full-time equivalent (FTE) staff in 2009. Additionally, the Beaverton Police Department is under the jurisdiction of the City of Beaverton, whereas the fire district (Tualatin Valley Fire and Rescue) and the parks district (Tualatin Hills Parks and Recreation District) are separate entities.

Figure 4: Description of the City of Beaverton's GHG Emissions Categories (2009)

WRI Scope	Emissions Category	MT CO ₂ e	Description
Scope 1 Direct Emissions	Fleet	1769	<p>This category includes emissions from Public Works, Police, and general City fleet vehicles. In 2009, 191,261 gallons of fuel were purchased.</p> <p>This inventory used data from 252 fleet vehicles, including sedans, trucks, vans and heavy construction vehicles:</p> <ul style="list-style-type: none"> • 162 vehicles used E10 (a blend of 10% ethanol and 90% unleaded gasoline). Since January 2008, the State of Oregon has required that all gasoline sold in northwestern Oregon must contain 10% ethanol. • 39 vehicles used E85 (85% ethanol and 15% gasoline). • 51 vehicles used B20 (20% bio-diesel and 80% diesel).
	Natural gas	790	The City used natural gas in seven facilities for space and water heating. Natural gas was also used in the City-owned Central Plant to generate heating and cooling products that were sold to residents and businesses within The Round multi-use development project in Beaverton.
	Other fuels	22	Diesel fuel was consumed in nine backup generators located at City Hall, the Community Center, the Main Library, the Public Works building, Harvest Court storage facility and four water facilities.
	Refrigerants	36	A total of 46.5 pounds of HCFC-22 (also known as R-22) was added to City Hall's heating, ventilation and air conditioning (HVAC) system during two separate repairs.
Scope 2 Indirect Emissions	Electricity	8,509	<p>Electricity emissions were calculated based on data from 11 buildings, City Park, street and traffic lights, and water pumping and treatment facilities managed by the City of Beaverton.</p> <p>The total emissions calculation was achieved using the emissions factor reported to the EPA for 2005 by Portland General Electric (PGE), the City's electricity provider. A comparison of emissions calculations using the Northwest Power Pool regional and U.S. national emissions factors can be found in the <i>Methods</i> section.</p>



Scope 3 Indirect Emissions	Business travel	196	This category includes emissions generated in vehicles not owned by the City, but used for mission-critical business travel. Sources included air travel, rental vehicles and employee-owned vehicles used for business travel
	Solid waste	134	Solid waste emissions were calculated based on weekly pickups from Waste Management at seven City facilities and a variety of public areas, as well as on-call pickups for construction debris, vector waste (street waste collected by a vacuum truck) and miscellaneous municipal waste. The City's waste went to the Riverbend landfill, where the methane produced was captured and flared.
	Commute	1,347	Emissions for this category were calculated based on data from a survey regarding staff commute methods.
	Supply Chain: Embodied emissions in purchased goods and services	13,000	The City spent over \$21.1 million on these purchased goods and services in 2009. The emissions from these goods were calculated based on costs of products and services not accounted for elsewhere in this inventory. The costs can be divided into four primary categories: <ul style="list-style-type: none"> • Construction & Maintenance (construction materials, maintenance and landscaping supplies) • Equipment and Furniture (computers, electronics, equipment, furniture and vehicles) • Goods & Materials (apparel, chemicals, library materials, office supplies, postage, printing and paper) • Professional Services (community improvements, grants, insurance, training and staff development)
	Water	5,235	These emissions represent the City's 26.5% share of the water treated and provided in 2009 by the Joint Water Commission (the main source of drinking water for the Cities of Beaverton, Hillsboro, Forest Grove and the Tualatin Valley Water District).





METHODS: DATA, PROTOCOLS, AND SENSITIVITY ANALYSIS

This inventory follows the Local Government Operations Protocol, which provides the highest-consensus guidelines for minimum reporting scope and was developed jointly by The Climate Registry and other organizations⁴. The protocol only requires the reporting of emissions in Scopes 1 and 2 (as defined by the World Resources Institute).

The City of Beaverton has gone further to include several shared emissions categories from Scope 3. This use of additional high-quality public-domain tools to estimate Scope 3 emissions makes this inventory more state-of-the-art than inventories focused only on mandatory or bare-minimum boundaries. This more integrated and holistic approach paints a more accurate portrait of total emissions associated with the City of Beaverton's way of doing business.

Emissions from some sources (such as natural gas consumption) were based on highly accurate data and accepted emissions factors. Emissions from other sources (such as employee commute) were estimated by combining available data with careful assumptions and sensitivity analyses. Still others (such as embodied emissions in purchased goods and services) were calculated using estimated data and emissions factors based on averages for the U.S. economy as a whole.

This section is designed to describe where the data was collected and the basic methodology, assumptions and level of estimation/accuracy for each emissions source.

Scope 1 Emissions

Fleet

GHG emissions from City-owned vehicles were calculated based on the total gallons of fuel purchased, fuel economy estimates and fuel types (E10, E-85, diesel and B20 biodiesel). For the purposes of this inventory, the vehicles were divided into three categories:

1. Public Works (heavy construction equipment, light trucks and utility trucks)
2. Police (sedans, vans and motorcycles)
3. General City fleet (sedans and light trucks)



The Fleet Manager supplied fuel economy averages for certain types of vehicles (e.g. sedans, pickups). These averages were calculated from odometer readings logged when vehicles were refueled. Fuel economy estimates were made for the remaining vehicles using information from the EPA's MPG ratings at www.fueleconomy.gov, or based on the fuel economy averages provided for similar vehicles.

Most fuel for the City fleet was purchased from Pacific Pride; however, there were rare occasions when an employee used a personal credit card to pay for fuel for a City vehicle. Such purchases were not included in this inventory due to the difficulty in obtaining those

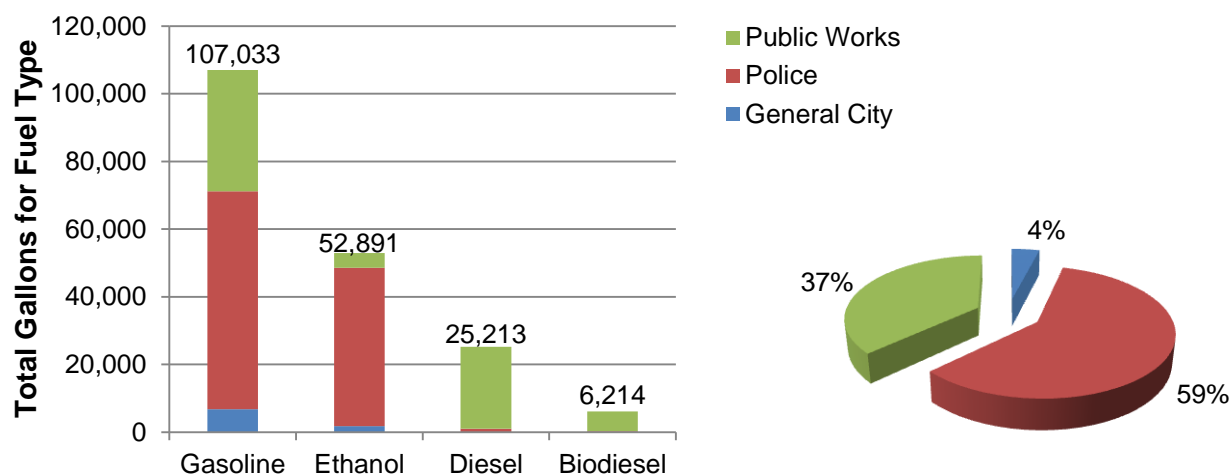
⁴ The Local Government Operations (LGO) Protocol was developed as a collaboration of The Climate Registry (TCR), the California Air Resources Board (CARB), the California Climate Action Registry (CCAR, now the Climate Action Reserve), and ICLEI Local Governments for Sustainability. The LGO Protocol follows the same format as The Climate Registry's General Reporting Protocol (GRP).



records. This was determined to occur infrequently enough that this exclusion did not impact the overall sense of scale of fleet emissions in this inventory. Additionally, because fuel for landscaping equipment was obtained at the same time that staff filled up their vehicles, the fuel used by this equipment was not tracked separately but was included with the vehicle fuel calculations. Fuel consumption for this equipment is considered to be very small in comparison to vehicle fuel consumption and should not detract from the overall accuracy of this emissions source.

The average fuel efficiency of Police vehicles, which were responsible for 59% of the City fleet's total fuel consumption, was 14.8 miles per gallon (mpg). In contrast, Public Works vehicles, which consumed 37% of the City fleet's total fuel purchases, had fuel economies ranging from 3.1 – 8.1 mpg. The General City fleet fuel economy was 14.6 mpg and accounted for the remaining 4% of the annual fuel consumption for 2009. To a certain extent, these fuel economies are based on the types of vehicles available for the necessary tasks by each department. There may be opportunities for fuel efficiency improvements over time.

Figure 5: Fuel Consumption by Fuel Type and Fleet Category for the City of Beaverton (2009)



The majority (69%) of the City fleet's GHG emissions originated from conventional fuels (gasoline and diesel). Alternative fuels (ethanol and biodiesel) produced the remaining 31% of emissions. Therefore, to some degree, 1,221 MT CO₂e of the City of Beaverton's fuel emissions can be considered anthropogenic (human-caused from the mining and combustion of fuels removed from the Earth's crust) and the remaining 548 MT CO₂e can be considered biogenic (associated with the biological carbon cycle as plants sequester carbon during growth and release it during combustion).

When exploring the use of biofuels as a GHG reduction strategy, it is important to look at the full life cycle of both fossil and plant-based fuels. Various biofuels can have very different life cycle carbon intensities based on the raw materials used for production and the energy intensity of the production processes. This inventory only calculates tailpipe emissions, but should consider calculating full fuel cycle emissions in the future. The life-cycle emissions of biofuels are still being studied and new biofuels are constantly under development. This fast-changing landscape requires recent sources and some analyses may have a short period during which they are defensible and credible. However, the California Air Resources Board (CARB)⁵ and

⁵ CARB's Low Carbon Fuel Standard. Access online at: <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>



the Oregon Department of Environmental Quality⁶ are currently creating full well-to-wheels analyses of many fossil fuel and biofuel pathways that apply to the fuels available in Oregon.

Natural Gas

The City's Property and Facility Manager provided the total therms of natural gas consumed in seven City facilities in 2009 for building and water heating. Additionally, the manager of the City's Central Plant⁷ provided data for that facility. Emissions for several small, rented facilities were calculated based on the regional average for space of similar size and purpose.



Other Stationary Fuels

The City operates nine diesel generators at various locations. Data from Bretthauer Oil, the City's fuel vendor, was incomplete; thus, Public Works staff calculated estimated fuel consumption totals for 2009. These estimates were generated based on the number of hours the generators were operated weekly and their fuel consumption rates. To be conservative, an additional 10% was added to the totals to allow for emergency use.

Refrigerants

The City uses HCFC-22 (also known as R-22) as a refrigerant in its heating, ventilation and air conditioning (HVAC) systems. Because HVAC systems have a closed-loop design, refrigerants are generally added only when HVAC repairs or maintenance are required, as seals and gaskets break down over time. In 2009, two separate repairs were made to City Hall's HVAC system, resulting in the addition of 46.5 pounds of HCFC-22. No refrigerants were added to any other City facility in 2009.

Scope 2 Emissions

Electricity

PGE, the local utility that serves the City of Beaverton, provided a report detailing the total kWh for 2009 for all City facilities and equipment (e.g. streetlights, traffic signals, water pumping stations). Additionally, the manager of the City's Central Plant provided electricity consumption data for that facility.

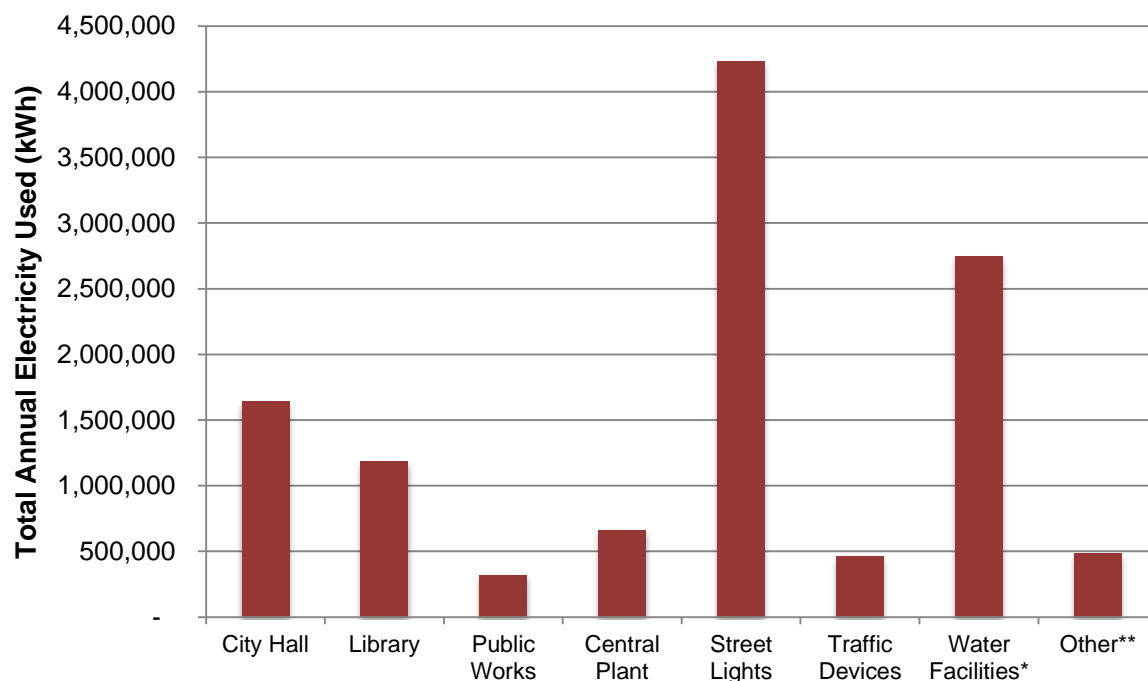
Since 2007, the City has been purchasing Clean Wind power and Green Source renewable energy offsets equivalent to the amount of electricity used in City buildings (not including street lighting and traffic lights). In 2009, the City purchased renewable energy credits (RECs) equivalent to 6,434,513 kWh. According to PGE, this was 41% of the total commercial renewable energy load in Beaverton. However, the RECs purchased by the City were not integrated into the electricity emissions calculations of this inventory because there is currently no established method by which to accurately assess the impact of the emissions reductions.

⁶ For more information on the GHG benefits of using bio-fuels see Oregon DEQ's low carbon fuels standards, available at: <http://www.deq.state.or.us/eq/committees/lowcarbon.htm> or California Air Resources Board Low Carbon Fuel Standard Program, available at: <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>

⁷ The Central Plant is a City-owned facility that provides highly efficient heating and cooling services, and domestic hot water, to the Round mixed use development complex in Beaverton.



Figure 6: Electricity Usage for City of Beaverton Buildings & Equipment (2009)

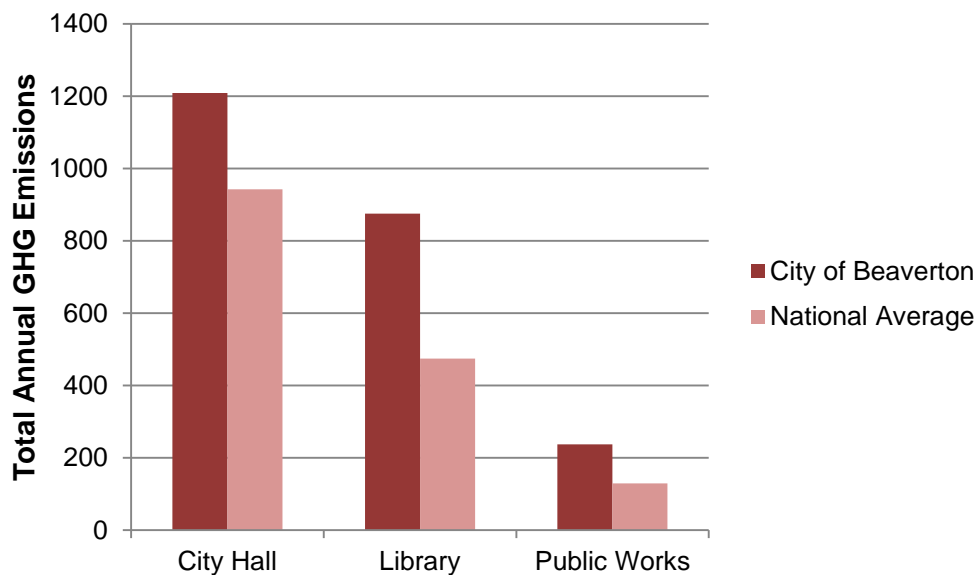


* Includes City water pumping stations, fluoride facility, and water vault and irrigation facilities. Does not include JWC electricity use.

** Includes City Park, Community Center, Resource Center, Harvest Court (storage facility), Police Training Center and Police Neighborhood Resource Centers.

Figure 7 (below) compares the total GHG emissions for three of the City of Beaverton's main buildings with the national average⁸ of GHG emissions for buildings of similar size and purpose.

Figure 7: Comparison of City of Beaverton GHG Emissions with National Averages (2009)



⁸ U.S. Energy Information Administration, 2003 Commercial Buildings Energy Consumption Survey
www.eia.doe.gov/emeu/cbecs/contents.html



The GHG emissions for the City of Beaverton's electricity consumption may be calculated using any one of the following three different emissions factors⁹:

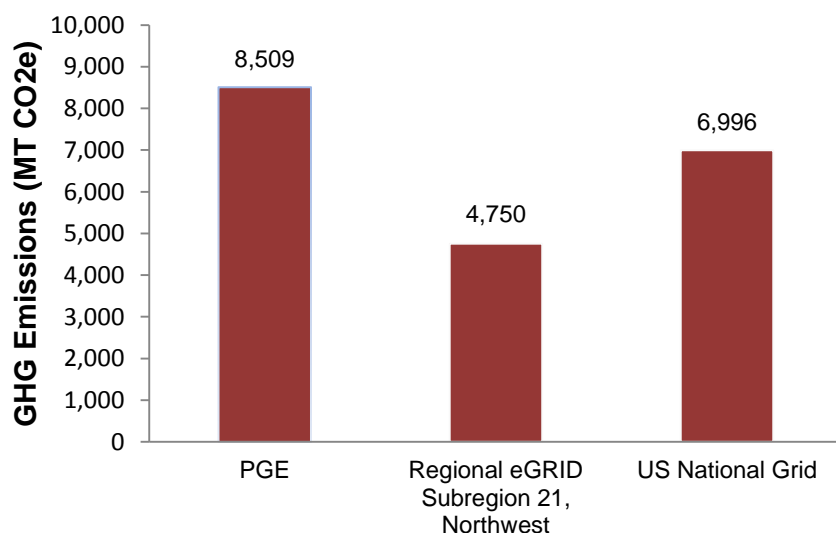
- 1) the emissions factor reported to the EPA for 2005 by PGE
- 2) the regional eGRID (Emissions & Generation Resource Integrated Database) emissions factor for the Northwest Power Pool as reported by the EPA for 2005
- 3) the US national emissions factor as reported by the EPA for 2005

The calculations reported in the above tables and graphs are calculated using the emissions factor for PGE, as reported by PGE to the EPA's Emissions & Generation Resource Integrated Database for 2005. The carbon intensity of PGE's generation is distinctly different from (higher than) the emissions of the regional and national grids. When these differences exist, it is important to compare their emissions to provide the proper sense of scale.

Since PGE is the utility directly serving the City of Beaverton, it can be considered the most appropriate emissions factor to use in these calculations. However, utilities are connected (often at peaks and troughs of production) to many outside power sources. Therefore, it is possible to argue that the regional grid is a more accurate number. In fact, since electricity is often traded over long distances, the national grid also has some meaning.

Figure 8 (below) shows how Beaverton's Scope 2 emissions would be different using the local utility emissions factor for PGE, the regional mix for the Northwest Power Pool, and the national mix for the United States.

Figure 8: Electricity Emissions Calculation Alternatives for the City of Beaverton (2009)



Scope 3 Emissions

Business Travel

In addition to using City-owned fleet vehicles, employees sometimes travel on City business by air, rail, rental cars, or in their own vehicles. The City's Finance Department provided printouts of business travel records from an electronic database, which included mode of travel and destination cities. Total passenger miles were calculated based on round trip mileage between

⁹ U.S. Environmental Protection Agency eGRID2007 Version 1.1, available from <<http://cfpub.epa.gov/egridweb>> (accessed April 20, 2010)



Beaverton and the destination cities (airline miles were computed on www.webflyer.com; driving miles were computed on www.randmcnally.com).

The bulk (96%) of the emissions for this category originated from air travel. A radiative forcing index (RFI) of 2.0 was used to adjust for the effect of air travel on the upper atmosphere.¹⁰

Occasionally, employees used their own vehicles for business travel and did not request mileage reimbursement; thus, these non-reported trips were not included in this inventory due to a lack of data. Because employee-owned vehicles contributed to only 3% of the City's total GHG emissions for business travel, the effect of this missing data is negligible considering the scale of the total City emissions.

Records of actual mileage traveled in rental cars by city staff were unavailable, so an average of 20 miles per day was assumed in order to calculate passenger miles. In 2009, there were only eight instances of rental car use which accounted for less than 1% of the total GHG emissions associated with business travel; thus, this mode of travel (and the accuracy of this assumption) did not have a significant impact on the total City emissions.

There were no records of City staff using buses for business-related travel. Although some employees occasionally use the Tri-Met Max light rail system to travel between Beaverton and Portland for meetings, no records of this mode of travel have been maintained. The impact of travel by light rail for business purposes is estimated to be small.

Compared to other emissions sources in this inventory, business travel produced a minute portion of the total GHG emissions for the City of Beaverton in 2009 (196 MT CO₂e out of a total of 31,038 MT CO₂e).

Solid Waste

Solid waste generated by the City of Beaverton in 2009 was sent to Riverbend Landfill in McMinnville, Oregon, where the methane (generated from the waste breaking down under anaerobic conditions) was recovered and flared¹¹. This inventory did not account for methane releases from the City's solid waste before it arrived at the landfill collection systems.

A portion of the emissions for the City's solid waste collection was estimated based on a weekly pick-up schedule with Waste Management, the City's waste hauler. These scheduled pick-ups included containers at City Hall, Public Works, the Main Library, Community Center, Resource Center, Police Training Center, City Park and the downtown core area. The assumption was made that these containers were full upon pick-up and the total volume for each container was then calculated based on the number of pick-ups per week and the container size.

The remainder of the City's landfill-bound solid waste was removed on an "on-call" basis. These pickups included containers for construction debris, vector waste (street waste collected by a vacuum truck), and miscellaneous municipal solid waste. Waste Management provided the total annual tonnage for these containers.

As with business travel, the calculated GHG emissions from this category were a small portion of the City's total annual emissions (134 MT CO₂e out of a total of 31,038 MT CO₂e).

¹⁰ Calculating the Environmental Impacts from Aviation Emissions:
http://www.jpnmorgancimatecare.com/media/documents/pdf/aviation_emissions_offsets.pdf

¹¹ Riverbend Landfill is in the process of building a plant for generating electricity from methane.



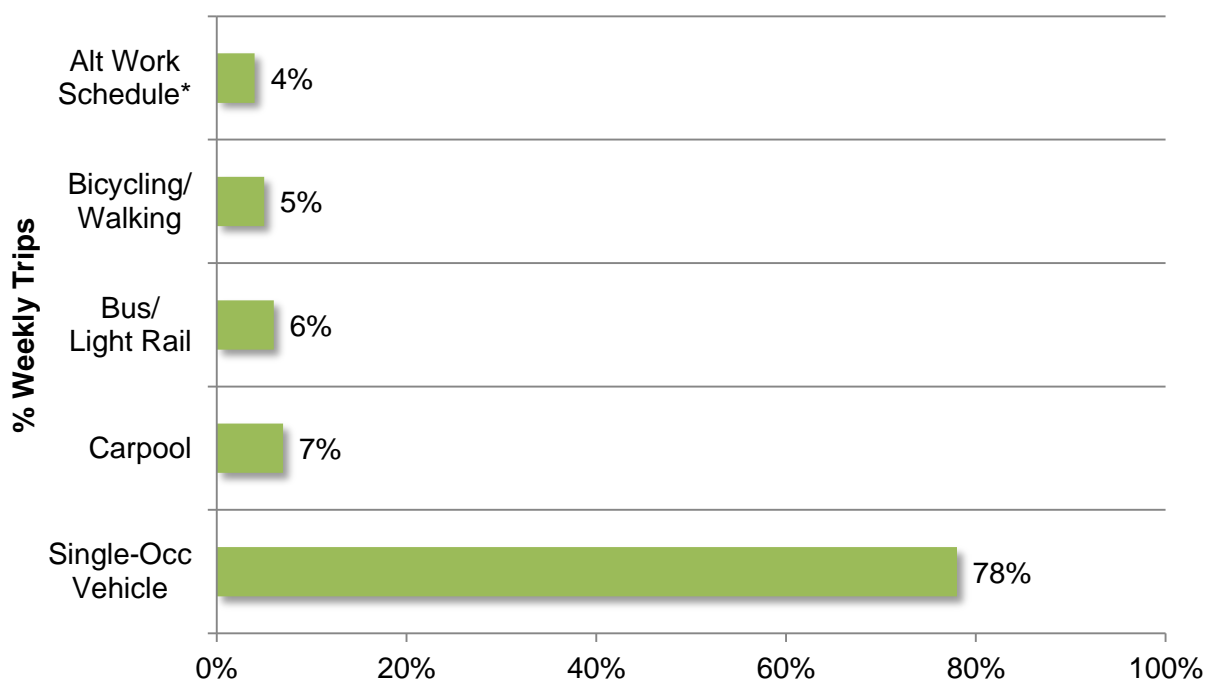
Commute

In compliance with the Oregon Department of Environmental Quality, the City of Beaverton sends an Employee Commute Options (ECO) survey to all staff every other year. The surveys are created by the Westside Transportation Alliance (WTA) and include questions about employee commute methods (e.g. single occupancy vehicles, carpools, public transit, walking, bicycling) and the resulting total number of weekly commuting trips.

The ECO survey results from May 2009 were used to calculate commute-related emissions for 2009. Missing from the survey were questions about commute distance and fuel efficiency. An estimated average commute distance of 15.56 miles was calculated based on the average Portland Metro commute time of 24.9 minutes (US Census Bureau 2006-2008 American Community Survey) and an estimated range of speed (30-50 MPH) was used. An average U.S. fleet fuel efficiency of 20.1 miles per gallon¹² was substituted for the missing employee-owned vehicle fuel economy average. Additionally, because bus and light rail travel data were combined in the ECO survey, the percentage was split in half for the purposes of this inventory.

While the City does not have any control over how its employees get to work, it can help to educate employees of alternative commute options and provide benefits and/or incentives to encourage employees to make less-GHG intensive transportations choices. Currently, the City offers subsidized public transportation (Tri-Met) passes to staff, and participates in several events throughout the year to encourage the use of these alternative commute options.

Figure 9: Weekly Trips by Commute Method for City of Beaverton Employees (2009)



* Participation in an alternative work schedule (e.g. telecommuting, compressed work week) was included in the survey and comprised the remaining 4% "commute trips."

¹² Environmental Protection Agency (2007): Light-Duty Automotive Technology and Fuel Economy Trends: 1975 through 2007. Source: <http://www.epa.gov/otaq/cert/mpg/fetrends/420s07001.htm>



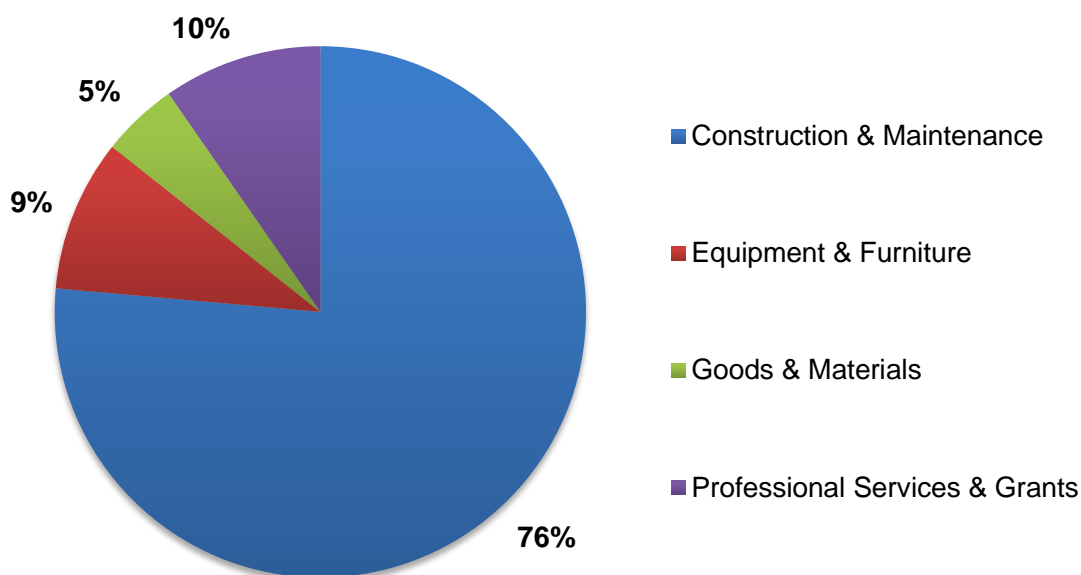
Supply Chain: Embodied Emissions in Purchased Goods and Services

For estimating the emissions associated with producing the goods and services purchased by the City of Beaverton, this analysis relied on Economic Input-Output Life-Cycle Analysis (EIO-LCA), a public-domain tool developed by Carnegie Mellon University.¹³ The EIO-LCA tool (2002 model) provides GHG emissions data per dollar of product purchased for 428 sectors of the US economy.

To begin the process of assessing the embodied emissions in the City of Beaverton's supply chain, the Finance Department provided a list of the City's total expenses for 2009. From this list, certain items were immediately excluded, such as the costs of any item already accounted for elsewhere in this inventory (e.g. fleet fuel, water and electricity purchases); salaries and other forms of employee compensation; and taxes and other types of funds transfers. The remaining expenses were then categorized based on the description of goods or services (e.g. construction, equipment, maintenance, office supplies, printing, professional services and vehicles). Emissions factors (MT CO₂e / dollar) for the corresponding categories were then found using the 2002 model within www.eiolca.net. These emissions were then adjusted for inflation.

The EIO-LCA tool is a valuable, but limited, instrument for determining a sense of scale of embodied GHG emissions for purchased goods and services. When evaluating these results, it is essential to bear in mind that the emissions reported here for the categories of purchases made by the City of Beaverton are based on emissions factors using aggregated national averages of similar products or services and are estimates only.

Figure 10: Embodied Emissions in Purchased Goods and Services for the City of Beaverton (2009)



¹³ Carnegie Mellon University Green Design Institute. (2010) Economic Input-Output Life Cycle Assessment (EIO-LCA), US 2002 Industry Benchmark model [Internet], available from: <<http://www.eiolca.net>> (accessed May-June 2010)



Water

The City of Beaverton holds shares in the Joint Water Commission (JWC), which provides drinking water to the Cities of Beaverton, Hillsboro, Forest Grove and the Tualatin Valley Water District. The JWC conducted a greenhouse gas inventory concurrently with the City of Beaverton and reported Beaverton's total emissions for 2009 as a 26.5% share of the water treated and provided by the JWC.

This category does not include emissions from electricity purchased directly by the City of Beaverton to treat and distribute water to Beaverton residents. Such emissions are included in the City's Scope 2 electricity emissions category.

CURRENT RELATED REGULATORY REQUIREMENTS OF THE CITY OF BEAVERTON

Mandatory Reporting in Oregon

In 2010, the Oregon Department of Environmental Quality began requiring GHG reporting for a wide range of entities. The threshold for reporting is currently set at 2,500 MT CO₂e annually. In general, the sources and entities required to report are holders of Title V air pollution permits or Air Contaminant Discharge Permits (ACDP) with at least one discrete permitted source emitting above the threshold. For more information on Oregon's rules, visit DEQ's GHG reporting page:

www.deq.state.or.us/aq/climate/reporting.htm

As currently articulated, these requirements will not require reporting from many organizations that have aggregate emissions from multiple sources (building energy, fleet fuel, etc.) that together exceed the reporting threshold. Municipal governments likely fall into this category of non-reporters. As a result, although many Oregon municipalities are likely to have total emissions from local government operations that well exceed 2,500 MT CO₂e annually, only a few will have regulatory reporting burdens.

The City of Beaverton does not hold a Title V air pollution permit or ACDP, nor does it have any individual direct emission exceeding 2,500 MT CO₂e. Thus, the City does not fall within the current guidelines for mandatory reporting.

Mandatory Reporting at the Federal Level

The US EPA has also issued mandatory reporting guidelines, finalized in Fall 2009 with amendments added in March of 2010:

www.epa.gov/climatechange/emissions/ghgrulemaking.html

The EPA requires fossil fuel providers, industrial greenhouse gas suppliers, vehicle and engine manufacturers and/or organizations that emit 25,000 MT CO₂e or more per year to submit annual GHG emissions reports. As of March 2010, the agency is also proposing to collect emissions data from the oil and natural gas sector, industries that emit fluorinated gases, and from facilities that inject and store carbon dioxide underground for the purposes of geologic sequestration or enhanced oil and gas recovery.

It is possible that federal climate legislation will require participation by some large entities in carbon trading and auctions for emissions allowances. Given the current structure of proposed legislation, very few Oregon entities – and probably no government agencies – will have such responsibilities.



COST OF CARBON: QUANTIFICATION AND RISK

Assembling a GHG inventory is an opportunity to analyze the implications of a “cost of carbon” (a direct or indirect cost associated with GHG emissions) to an organization as a result of policy.

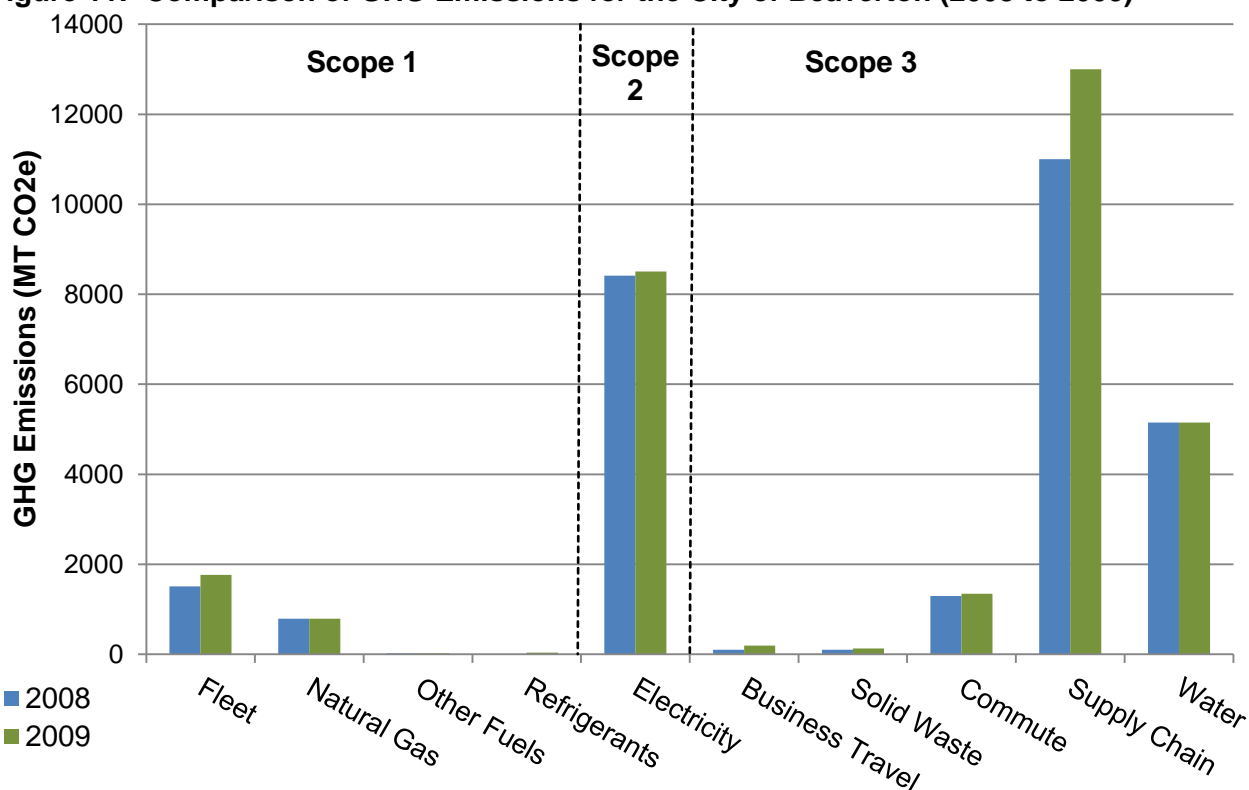
Many analyses of proposed legislation have indicated a likely range of this cost and we can see examples in countries that have already capped CO₂ emissions. Recent EPA analysis¹⁴ of the American Clean Energy and Security Act of 2009 suggests that within a few years of implementing a cap-and-trade system, the cost of carbon could be around \$15 per MT CO₂e. One proposed “reserve price” (or price floor) is \$10, while short-term “escape hatch” prices (or price ceilings) have been around \$30. This rough calculation is an approximation of the financial risk that could emerge under likely climate policy scenarios, and the range provides a sense of the City of Beaverton’s total direct and indirect financial exposure related to a cost of carbon.

The total financial risk is unlikely to be borne entirely by the City of Beaverton. Indeed, just as part of the carbon footprint is shared with others – from employees who commute to vendors that supply the organization with goods and services – the cost-of-carbon will likely be shared.

COMPARISON WITH 2008 GHG INVENTORY

In 2010, the City of Beaverton completed GHG inventories of City operations for the years 2008 and 2009. The total emissions increased by 8.6% from 28,593 MT CO₂e in 2008 to 31,038 MT CO₂e in 2009.

Figure 11: Comparison of GHG Emissions for the City of Beaverton (2008 to 2009)



¹⁴ http://www.epa.gov/climatechange/economics/pdfs/HR2454_Analysis.pdf

**Figure 12: Comparison of GHG Emissions for the City of Beaverton (2008 to 2009)**

Emissions Source	2008 Emissions (MT CO ₂ e)	2009 Emissions (MT CO ₂ e)	Notes
Fleet	1,509	1,769	Total fuel consumption grew by 10%. Use of conventional fuels declined by 10%, yielding a 16% decrease in emissions. In comparison, biofuel use soared by 119% but produced only a 16% rise in emissions.
Natural Gas	789	790	No significant change.
Other Fuels	22	22	No significant change.
Refrigerants	0	36	Two separate repairs to City Hall's HVAC system in 2009 resulted in additions of the refrigerant HCFC-22.
Electricity	8,417	8,509	Electricity use increased by 1%.
Business Travel	99	196	A moratorium was imposed on travel in the first half of 2008.
Solid Waste	100	134	Construction waste increased significantly in 2009.
Commute	1,294	1,347	Automobile trips increased in 2009.
Supply Chain	11,000	13,000	The data drawn from the EIO/LCA tool originated from 2002; thus, the inflation rate used in the emissions calculations increased in 2009.
Water	5,363	5,235	The total gallons purchased from the JWC decreased by 1.5%.

SUSTAINABILITY AT THE CITY OF BEAVERTON

The City of Beaverton has already taken many steps toward a sustainable future, including:

- becoming a US Mayors Climate Protection Agreement signatory in 2006 (www.usmayors.org/climateprotection/agreement.htm)
- supporting a progressive recycling and solid waste management program since the 1990's
- hiring a Sustainability Coordinator in 2009
- establishing an internal program to reduce single-occupancy commutes (subsidizing public transportation passes; encouraging bicycling, walking and carpooling options; and offering flexible work schedules)
- striving to increase energy efficiency in all City facilities through partnerships with the Energy Trust of Oregon
- purchasing renewable energy credits annually through PGE's Clean Wind and Green Source programs since 2007
- becoming an EPA Green Power Partner in 2007 for exceeding EPA guidelines for buying clean, renewable energy



The completion of the 2009 greenhouse gas inventory is one more action taken by the City of Beaverton toward creating a sustainable, livable community. Inventories will be conducted on a regular basis in order to track the City's progress in reducing GHG emissions.

CONTACT INFORMATION AND ADDITIONAL RESOURCES

Acknowledgments: Cindy Tatham and Vanessa MacLeod conducted this inventory for the City of Beaverton. Numerous City staff contributed data and time to the GHG inventory, including: Brion Barnett, Craig Crawford, Anna Grigat, Scott Keller, Liz Jones, Sheila Marler, Margaret Middleton, J.J. Schulz, Mike Sterle, Gary Thompson, Faye Turner, Pat VanOsdel, and Jessica Walker.

Additional contributions were made by staff from City vendors, including: Jason Brown (Waste Management), Teri Carter (Waste Management) and Tiffany Ritchey (Portland General Electric).

For more information, visit www.beavertonoregon.gov/green or contact Cindy Tatham, Sustainability Coordinator for the City of Beaverton, at (503) 526-2545 or ctatham@ci.beaverton.or.us.

This GHG inventory was completed as a part of the City of Beaverton's participation in Operation Climate Collaborative (OCC), a multi-jurisdictional process led by Good Company (www.goodcompany.com). Good Company facilitated the use of its proprietary calculation tool (Good Company's Carbon Calculator, or G3C), technical assistance related to and quality checks of the calculator's use, offered support and guidance in data gathering and the development of estimation methods, and provided the template for this document. Staff of the City of Beaverton prepared this report. For more information about OCC, visit www.goodcompany.com/occ or contact Joshua Skov (joshua.skov@goodcompany.com), (541) 341-4663, ext. 211).

